



# Tropospheric Ozone and CO Monthly Mean Fields from TES and GEOS-CHEM Model

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## 1. Introduction

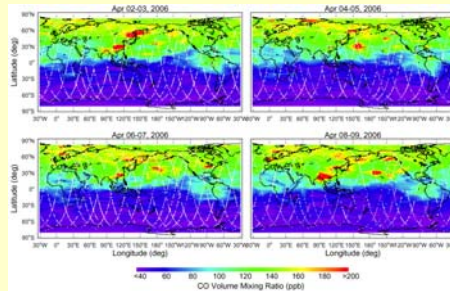
### TES Level 3 Monthly Means

- The TES Global Survey (~26 hrs, 16 orbits) data taken with a one-day-on followed by one-day-off mode are used for deriving species monthly mean fields. An example data calendar is shown below.
- At each TES pressure level, the TES species volume mixing ratios for the given month and in a  $5^\circ \times 1.5^\circ$  longitude by latitude box are averaged weighted by their distance to the given TES L3 grid point.



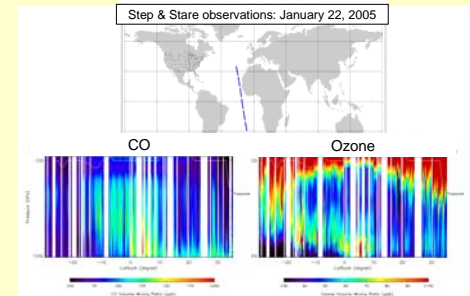
### TES Daily Species Fields

- There are coverage gaps in TES global survey (GS) measurements. Examples shown below are the CO global distributions for four consecutive GSs with data interpolated from the 16 along orbit nadir measurements per GS.
- The monthly averaged species fields will not be able to capture the fast moving and the un-sampled features.

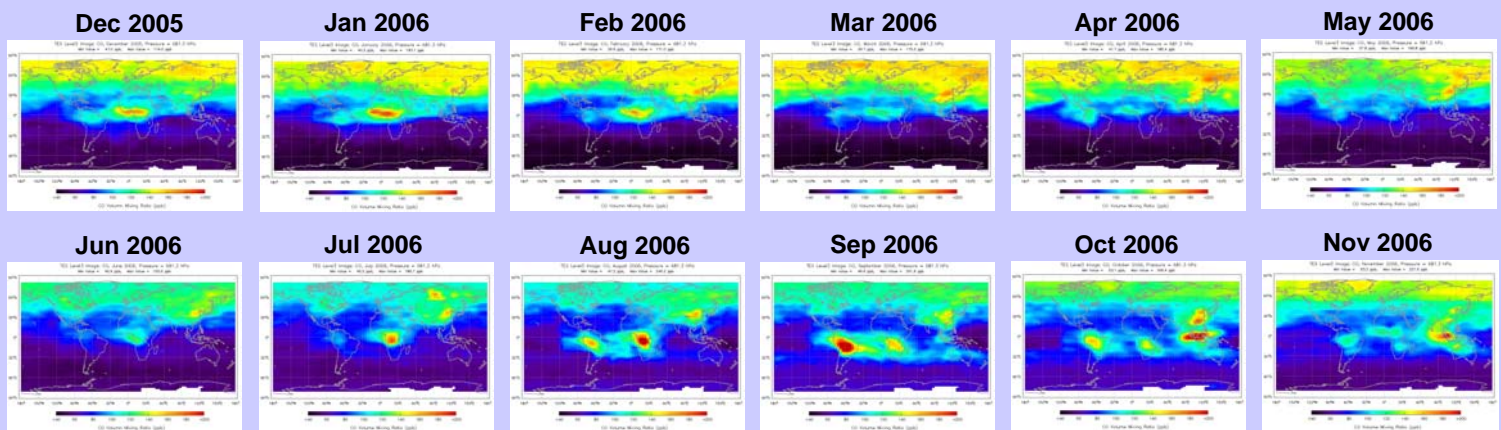


### TES Provides Vertical Profiles

- TES Global Surveys and Special Observations provide vertical profiles of Ozone and CO in the troposphere, as shown in the example below – pressure vs. latitude curtain plots for O3 and CO.
- TES L3 monthly means are provided at diff vertical levels.

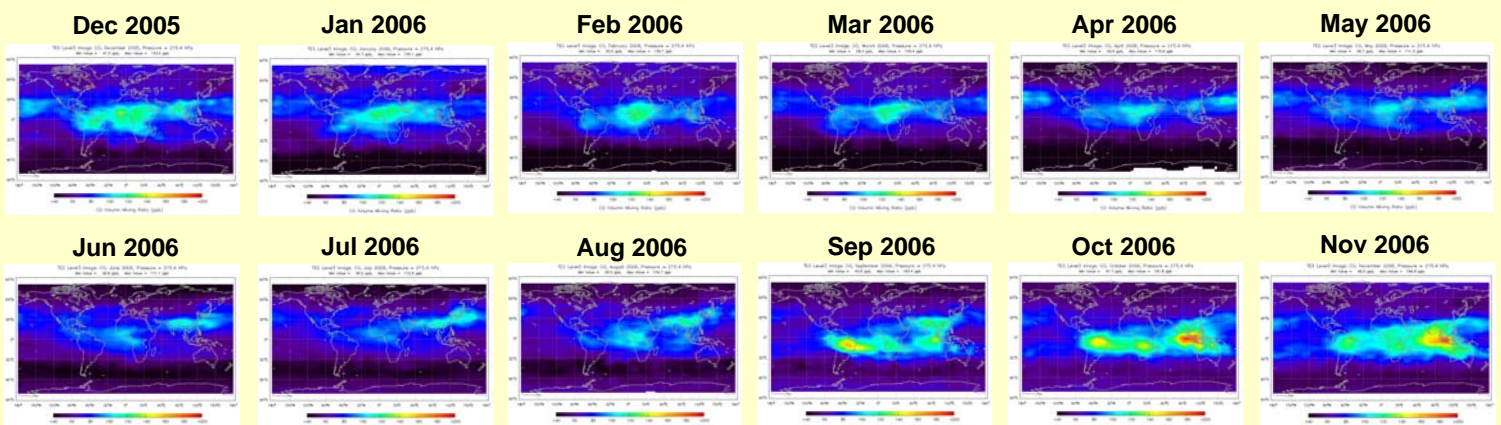


## 2. TES CO in the Lower Troposphere: Monthly Fields at 681.3 hPa



- TES CO fields in the lower troposphere clearly coincide with known biomass burning and pollution sources near the surface and show expected seasonal transport / chemistry patterns.
- CO in Northern Hemisphere > Southern Hemisphere; Higher CO in boreal winter / spring in high northern latitudes.
- Biomass burning areas of Africa at North and South of equator in the two seasons respectively and Aug-Nov in S. America.
- Pollutions (high CO) over China in all seasons; High CO was also observed in Jul Siberia and Oct-Nov Borneo & Sumatra fires (Indonesia, 2006).

## 3. TES CO in the Upper Troposphere: Monthly Fields at 215.4 hPa

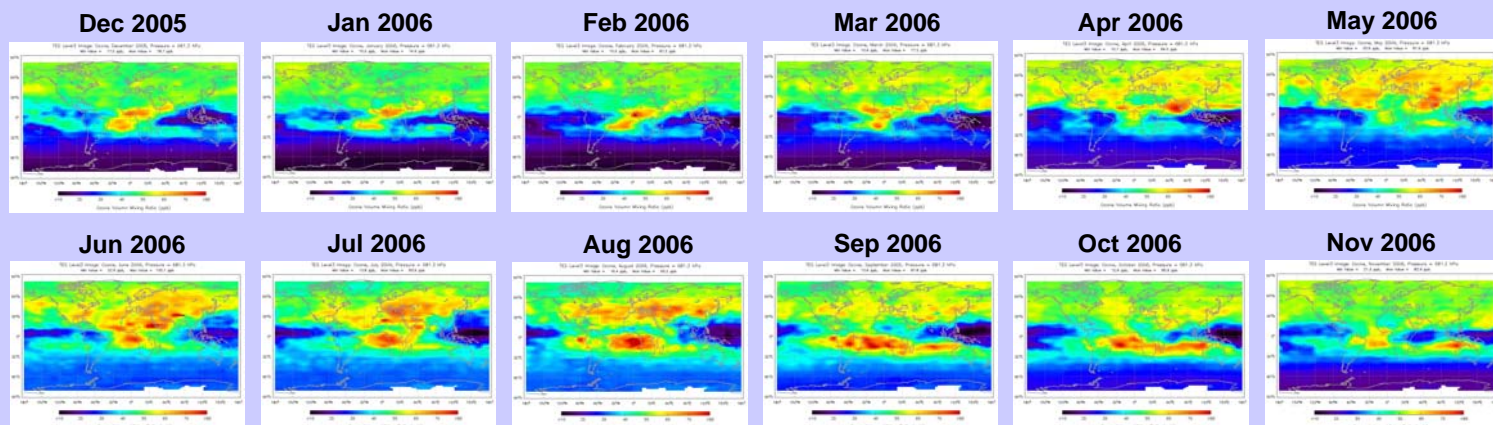


- TES CO fields in the upper troposphere show higher values in the tropics, associated with active upward convective transport in the latitude region. The enhanced CO can also be related to the enhanced CO values in the regions in the lower troposphere, e. g., over Indonesia, Oct-Nov, 2006



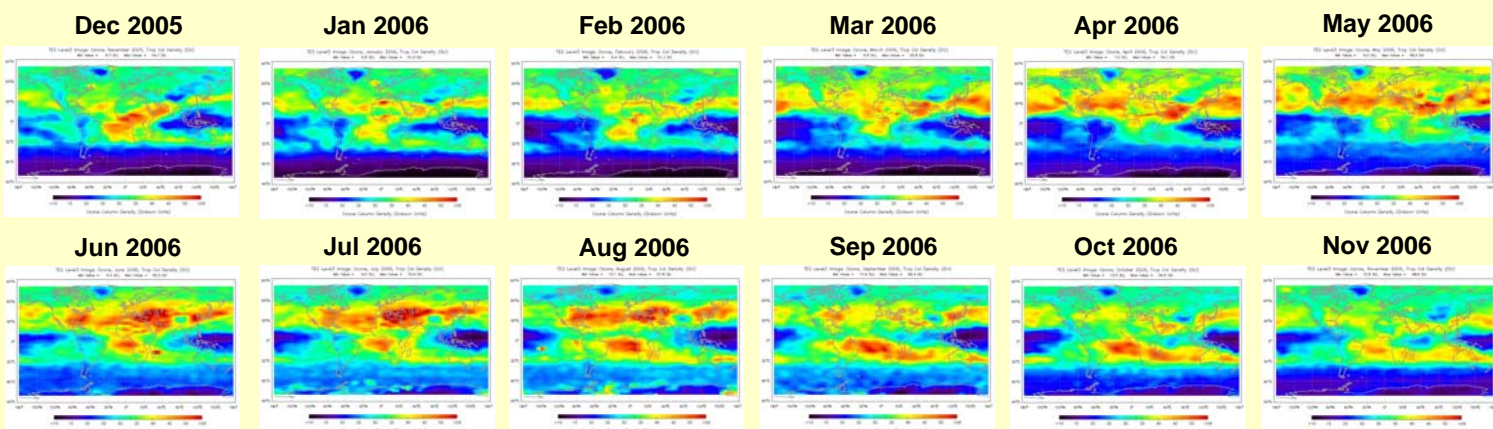


#### 4. TES Ozone in the Lower Troposphere: Monthly Fields at 681.3 hPa



- TES provides first global retrievals of tropospheric Ozone. TES O<sub>3</sub> fields agree in general with current understanding of the tropospheric ozone distributions.
- Ozone in Northern Hemisphere > Southern Hemisphere; Higher Ozone in boreal spring / summer in mid northern latitudes.
- Tropics: enhanced O<sub>3</sub> correlated with enhanced CO in the biomass burning areas of Africa and S. America and S Atlantic Ocean (wave-one pattern). There are also high O<sub>3</sub> displaced from the CO highs, e.g., double max in Dec-Feb, Africa / S. Atlantic Ocean; enhanced O<sub>3</sub> in S of Indonesia, Sept-Nov 2006.
- Other noticeable enhanced O<sub>3</sub> areas in NH: India/Arabian Sea in Apr-May; Max centered in Mediterranean Sea (covering 120W-120E) in spring/summer.

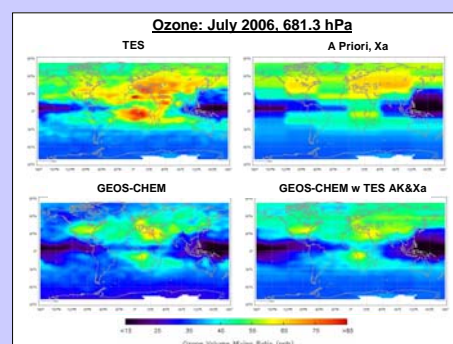
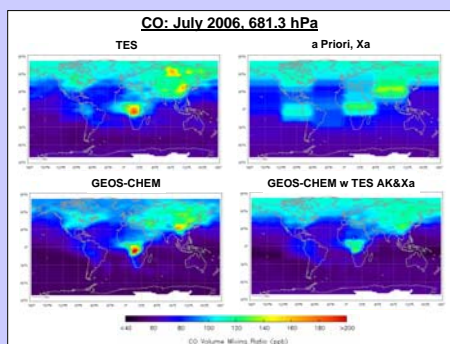
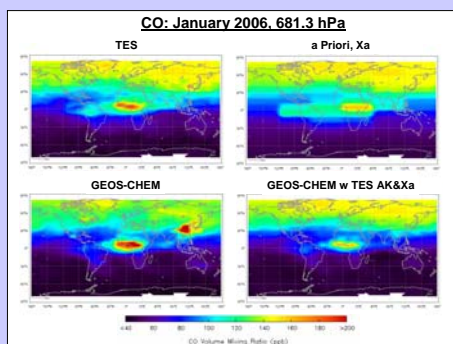
#### 5. TES Ozone: Monthly Fields for Troposphere Column



- These tropospheric columns for Ozone are generated with TES O<sub>3</sub> profiles and the GEOS tropopause pressures. They are useful in comparisons with the tropospheric Ozone columns derived other ways, e.g., MLS / OMI residuals.
- The distribution patterns for TES O<sub>3</sub> trop column monthly means are similar to those for O<sub>3</sub> in the lower troposphere.

#### 6. TES and GEOS-CHEM Comparisons

(The GEOS-Chem model results provided by Harvard Atmospheric Chemistry and Modeling Group)



- Four monthly fields are shown for each of the selected comparisons: TES retrieved CO and Ozone, the *a priori* fields used in the TES retrievals, the GEOS-CHEM model fields sampled at TES observation geo-locations, and the GEOS-CHEM model fields after applied TES averaging kernel and *a priori*.
- The comparisons become better/worse after applying TES AK and *a priori* to the model profiles – indications of the influences of the *a priori* info to the TES retrievals.